JOURNAL *of* THE SOCIETY OF CHEMICAL INDUSTRY

# CHEMISTRY & INDUSTRY

**Official Organ of the Institution of Chemical Engineers, of the Coke Oven Managers' Association, and of the Federal Council for Chemistry**

which consists of Representatives from

The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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## EDITORIAL

### Tomatoes

THE canning of tomatoes is a new industry in Jersey, and Jersey is an ideal place for the establishment of a tomato cannery, as the fruit shipped to England must be three days under-ripe, and, in fact, is still green, to allow for the time taken in shipment and distribution. Those too ripe for export are however at the correct degree of ripeness for canning and thus much fruit that would otherwise be wasted is put to profitable use. In Jersey, incidentally, the tomato is grown in the open, although in the sister island, Guernsey, it is cultivated under glass as in England. The tomato is an interesting fruit from the chemist's point of view, if it can correctly be termed a fruit and not a vegetable, although actually it does not lie easily under either heading and this is borne out by its acidity, which is between that of fruits and vegetables. Tomatoes have a high vitamin content, although their red colour is not due to carotene, but to its isomer lycopin: carotene is however also present. The vitamin-C content is also high. It looks incidentally as if the synthesis of vitamin-C, or ascorbic acid, as we suppose it should now be called, will be accomplished in the near future; a very notable achievement in the history of biochemistry. Advance in the study of this vitamin has been very rapid in the last eighteen months and great credit is due to the workers of several nations for their success in their joint attack on the problem, which might easily have been made more obscure by the red herring thrown in their path in the guise of methyl-nor-narcotine. It is perhaps appropriate that the antiscorbutic vitamin should be the first to be synthesized as its history goes back longer than any of the others. That lemon juice would prevent scurvy has been known since Elizabethan days at least, for we find it recorded in Hawkins' account of his voyage. The knowledge however seems to have been seldom applied. It may also be remembered that Captain Cook was awarded the Copley Medal of the Royal Society for his contributions on the subject. The canning of tomatoes is largely an American industry; in fact the Americans can more tomatoes than anything else, although the canning of corn and of peas is also extensively carried out. One great advantage of the tomato for canning is that its by-products, the skins and other trimmings, go to help in the manufacture of such products as tomato soup, sauce, and ketchup. These are chiefly manufactured in this country from French and Italian purée. We should be interested to know if any work has been carried out on the chemistry of the yellow variety of tomato. It might be an interesting study as the interrelationships of the plant pigments are still almost a sealed book and yet some relationship must exist, as instanced by the change on ripening from the green colour of unripe tomatoes, due to a chlorophyll derivative, to the red hydrocarbon. The study of the ripe yellow tomato might well throw light on an obscure subject. A great deal of other light will be thrown on the carotene and allied pigments when we publish, as we shall shortly, Prof. Kuhn's paper read at the meeting of the British Association.

### Light and Enlightenment

From time to time we have referred in these columns to the importance of popular scientific exposition: to the welcome which in these days of mechanical transport and wireless transmission and amateur dietetics await adequate but attractive and sufficiently simple accounts of the sciences for the enlightenment of non-specialist readers. We have expressed the view that those who try to avoid the sensational—of which we are all getting a little tired—but present a soberly balanced account of the spirit as well as the technicalities of their science are performing a real service both to the public and to the cause of scientific progress, for thereby they cultivate familiarity with scientific method which cannot but lead to the more efficient conduct of public affairs. Lest we should be thought to speak with the voice of the pedagogue, let us hasten to explain that we are all "laymen" except in our own corner of the field, and that we take our own interest in, and appreciation of

other branches of knowledge to be merely one example of a very widespread attitude, not confined to highly educated people, towards thought and discovery. It is by no means easy to write with simplicity and yet with accuracy and authority on scientific subjects which are known to us to bristle with highly complex matters still but imperfectly understood, and it is perhaps still harder to resist the temptation of turning ourselves into mere showmen, ringing the familiar changes on, for instance, atomic structure, transmutation, and the vitamins, fundamental as these subjects are. Fortunately on the chemical platform we have several first-rate exponents of our science ; authors whose works are read as eagerly by their colleagues as by the wider circle of readers for whom they are intended. Among physicists none is better known than Sir William Bragg, whose new book " The Universe of Light " (Bell, 12s. 6d.) is a splendid example of the kind of service we have in mind. Sometimes it happens that those who write don't know, and sometimes that those who know won't write ; when, however, a leader of scientific progress assumes with equal distinction the rôle of a master of popular exposition, we are indeed doubly fortunate. Sir William Bragg writes on optics in terms which convey his meaning admirably to the general reader, and we think that no one, least of all a chemist, who has the opportunity of borrowing this book will return it before he has either read it or bought a copy to read forthwith. The title of the book is that of a course of lectures, " adapted to a juvenile auditory," which Sir William gave at Christmas time in 1931 at the Royal Institution ; but although making use of the experiments then employed, he has of course " carried their description and the arguments based upon them much further than was proper or possible during the lectures." He explains in his preface that he takes as the thread of his story the old rivalry between two theories of light which has been one of the most powerful contributors to the development of science ; he points out that there is to be a reconciliation of hypotheses which we had thought to be mutually exclusive, " and the fact warns us of the danger of allowing our mental imaginings to become fixed beliefs." We chemists have good reason to applaud the wisdom of this warning, and to admit the need for it. In public life it is equally pertinent. Despite the fact that human nature provides a variable factor which does not admit of measurement, there are times when the conduct of affairs appears to the scientific observer to be based on fixed beliefs rather than on considerations of ascertained fact and estimated probability. It is neither uecessary nor desirable that we should all be physicists or chemists, though we shall gain interest and exercise and culture from such studies. What is important is that while admiring scientific achievement and gaining a more intimate knowledge of the world around us we should learn to appreciate, and appropriately to apply, scientific method.

### The Soviet Chemical Industry

The Five-Year Plan has necessarily included a chemical industry and it is stated that the growth of this has been one of the outstanding achievements of the plan ; it is said to have involved an expenditure of 1500 million roubles devoted to the production of sulphuric acid, nitrogen, mineral salts, superphosphate, synthetic rubber, artificial fibre, drugs, aniline and lacquer dyes. The production of sulphuric acid has grown from a pre-war figure of 150,000 tons to 800,000 tons last year. An account of the progress is contained in a recent issue of the Monthly Review of the Moscow Narodny Bank. For reasons which we cannot afford space to discuss, the chief of which is the difficulty of getting foreign exchange, Russia, like too many other countries, has embarked on a policy of manufacturing everything for herself. A country of such vast area must have enormous untapped and even undiscovered resources in the shape of natural products, which the chemist and the chemical engineer can exploit, and it must be expected that given the necessary supply of skilled chemists Russia will continue to expand indnstries which are based on these. In this respect, Britain, of small area and with our mineral potentialities largely known, is at a disadvantage, our greatest asset being our wealth in skilled workers. This fact can never be sufficiently emphasized and to maintain the asset it should be the duty of each and every one of us to influence the mental development and technical training of even the humblest of his employees. Returning to Russia, we note for example that vast qnantities of apatite have been discovered and that the deposits of phosphate in reserve are estimated at 1200 million tons, a thirty-fold increase in five years. This is a most important find in view of the world need for phosphatic manures. Another mineral peculiar to Russia, of which large deposits have been found, is nepheline—a sodium, potassium, aluminium silicate of considerable industrial importance. Anthracene is another chemical of which the Russian production is expanding, the output this year being expected to reach 1500 tons and to expand five-fold within the next three or four years : it is difficult to see an outlet for this quantity of material unless new uses are found for it. During the same period the value of the chemicals imported into Russia has fallen materially amounting last year to only one-sixth of what it was in 1930. It is quite clear that chemically Russia is changing from an importing to an exporting nation, and it is desirahle for onr chemical manufacturers to realize this fact. The world over it is becoming more easy and in fact definitely more economical to manufacture where there are the richest deposits of raw materials and the factories are largely going to the raw materials instead of the reverse process taking place as hitherto. Such a change brings new problems, technical and economic, in its train—problems and changes which perhaps concern Great Britain more than any other country for if they materialize, we, with our old-established industries, will be the most affected. The foreigner is often most aided by our best consultants and free-lances whose services are neglected by the home manufacturer : we suggest this in passing as one minor source of leakage of our industrial supremacy, remembering that when the ship is in danger no leak is too small to be overlooked.

## THE COMBUSTION OF HYDROCARBONS*

**By PROF. WILLIAM A. BONE, F.R.S.**

In introducing the subject Prof. Bone said that as the outcome of much controversy towards the end of last century former erroneous notions of a preferential burning whether of hydrogen or of carbon in hydrocarbon combustion were finally overthrown and the way opened for new interpretations of the mechanism of the process, and more particularly for one originally suggested by H. E. Armstrong as far back as 1874, namely, that its successive stages involve the transient formation of unstable hydroxylated molecules which, according to circumstances, decompose more or less rapidly under the influence of heat giving rise to simpler intermediate products, and finally to steam and oxides of carbon, so that the process as a whole might be visualized as essentially one of hydroxylation.

Prof. Bone proceeded to show how this view had been substantiated by the results of the systematic researches of his collaborators and himself upon the slow combustion of hydrocarbons, chiefly methane, ethane, propane, ethylene, and acetylene, from 1898 up to the present day. These had proved the successive intermediate formation of alcohols, aldehydes, and acids, *e.g.*, with methane—methyl alcohol, formaldehyde, and formic acid: with ethane—ethyl and methyl alcohols, acet- and formaldehydes, acetic and formic acids; and with ethylene—vinyl alcohol and its isomers ethylene oxide and acetaldehyde, formaldehyde, and formic acid. Pressure so favoured the stabilization of the mon-hydroxy product (*i.e.*, the alcohol) that at high pressure it can easily be isolated in quantity from among the oxidation products. The latest development in this connexion has been the recent isolation of vinyl alcohol as the initial product of the oxidation of ethylene, together with the proof of its undergoing reversible transformation into its isomers, ethylene oxide and acetaldehyde, in such a manner that there results a triangular equilibrium between them, the relative proportion of the three isomers depending on temperature and pressure.

Passing on to the subject of explosive combustion, Prof. Bone said that although the conditions prevailing in hydrocarbon flames and explosions are obviously much more complex than those of slow combustion, the experimental evidence strongly supported the view that the result of the initial encounter between hydrocarbon and oxygen is the same in both, namely, the formation of an hydroxylated molecule. Undoubtedly at the high temperature of flames, secondary thermal decompositions set in at an earlier stage, and play a more conspicuous rôle than in slow combustion, but they do not precede the onslaught of the oxygen upon the hydrocarbon, but arise in consequence thereof. Moreover, it seems probable that in explosive combustion, whenever the oxygen supply suffices, there is a (so to speak) "non-stop" run through the mon-hydroxy to the di-hydroxy stage before thermal decomposition sets in; albeit, in default of such oxygen-sufficiency, more or less decomposition at the mon-hydroxy stage would occur, and in still greater oxygen-defect some of the excess hydrocarbon might also be decomposed.

* A lecture, with experiments, delivered before the Chemical Society at the Royal Institution, London, on October 19, 1933.

He next proceeded to elaborate this view, and to demonstrate experimentally its applicability to the explosive combustion of all known gaseous hydrocarbons. First of all he showed some striking explosions of $C_2H_2 + O_2 + 2H_2$, $C_2H_4 + O_2 + H_2$, $C_3H_6 + 1\frac{1}{2}O_2 + H_2$, etc. mixtures proving (from the fact that in no case does carbon separate nor any steam condense on cooling, owing to the hydrocarbon monopolizing all the oxygen in burning to carbonic oxide and hydrogen) how vastly greater is the affinity of a hydrocarbon than that of hydrogen for oxygen in flames. He showed also the $C_2H_2 + O_2 + 2H_2$ result to be practically unaffected by dilution of the explosive media with an equal volume of helium, argon, or nitrogen respectively, or even by increasing the hydrogen up to $C_2H_2 + O_2 + 4H_2$.

At first sight it might seem (as Prof. Armstrong had recently suggested) to be hardly a question of kinetics at all, but rather one of ball-room tactics, the oxygen preferring the good-looking hydrocarbon molecules to those of the plainer hydrogen, who were left as "wall-flowers"; for there is more in combustion than was yet dreamed of in our philosophies. Albeit further experiments on $CH_4 + O_2 + xH_2$ and $C_2H_4 + O_2 + xH_2$ explosions at high pressures had shown that in the long run hydrogen does exert its mass influence upon the oxygen distribution.

He next exploded $CH_4 + O_2$, $C_2H_3 + O_2$, $C_2H_4 + O_2$, $C_2H_2 + O_2$ mixtures in stout glass vessels, showing how the behaviour of each fulfils the prediction of the "hydroxylation" theory. He proceeded to demonstrate how different were the behaviours of olefines and paraffins on explosion with proportions of oxygen corresponding with $C_nH_{2n} + \frac{n}{2}O_2$ and $C_nH_{2n+2} + \frac{n}{2}O_2$ (*i.e.*, with just sufficient oxygen in each case to burn the carbon to carbonic oxide leaving the hydrogen intact). Whereas the olefines yield substantially carbonic oxide and hydrogen only, without any carbon deposition—as though by a preferential combustion of carbon—the paraffins yield abundance of carbon, methane, hydrogen, and steam, as well as oxides of carbon. Such behaviours were, however, quite in harmony with the hydroxylation theory.

Another remarkable feature of explosions of olefine-oxygen mixtures was demonstrated by exploding the mixtures $3C_2H_4 + 2O_2$, $C_3H_6 + 1\frac{1}{4}O_2$ and $C_4H_8 + 1\frac{1}{2}O_2$ each containing less oxygen than the $C_nH_{2n} + \frac{n}{2}O_2$ proportion. Whereas with the last named little or no steam had been produced on explosion, both separation of carbon and condensation of steam now occurred, showing that when the oxygen present was inadequate to eliminate all the postulated $:CH_2$ units as $H_2:C:O$, a breakdown must occur of a CH:CHOH complex with production of both steam and carbon.

Continuing, Prof. Bone referred to an important new discovery concerning the influence of pressure upon the spontaneous ignition of hydrocarbon-air mixtures, made by Dr. Townend in his laboratories, which had a direct bearing upon the problem of "knock." So far experiments had comprised the explosive ranges of *n* and *iso* butane and *n* pentane and were being extended over other hydrocarbons. It had been discovered

ıat as *the pressure was progressively raised from* to 15 atmospheres in each case, the observed ignition ːmperatures fell into two well-defined groups separated y a temperature range in which no ignition points ·curred. *Transference of an ignition point from the* gher to the lower groups occurred on the attainment a definite critical transition pressure which varied ightly with the compositions of the mixture; moreover, *e presence of an "anti-knock" compound at pressures* ·ar *the critical transition pressure effected a transfer the ignition point from the lower to the higher group.* ıe *explanation of the phenomenon was probably* nnected *with the influence of pressure on the stability* some one or other of the oxygenated compounds termedially formed.

In concluding, the lecturer stated that as the outcome a vast amount of experimental work embracing ery condition between slow combustion and detonation, ·luding pressures between $\frac{1}{4}$ and 100 atmospheres, · cumulative weight of evidence left no doubt in his nd that *"hydroxylation" afforded the best general* w of the normal course of hydrocarbon combustion. recent years, however, there had been much talk of · initial association of hydrocarbon and oxygen ulting in a "peroxide" rather than an hydroxylated lecule, thus:

$$R\cdot\overset{H}{\underset{H}{C}}-\overset{H}{\underset{H}{C}}\cdot R + O{:}O = R\cdot\overset{H}{\underset{\underset{\underset{H}{O}}{O}}{C}}-\overset{H}{\underset{H}{C}}\cdot R \text{ or } R\cdot\overset{H}{\underset{H}{C}}\cdot O\cdot O\cdot\overset{H}{\underset{H}{C}}\cdot R \text{ etc.}$$

ring the past four years his colleagues and himself sought diligently, but wholly in vain, for experimental dence of such initial peroxide in the slow combustion nethane, ethane, propane, and ethylene; for although nistakable signs of secondary "peroxidation" of ehydes had been found there had been none of any nary peroxidation of the hydrocarbon itself. Thus, he case of a $2C_2H_4 + O_2$ mixture at 300° C., no trace atever of peroxide during the induction period was nd, although aldehyde was always discernible; the subsequent "reaction period" no peroxide eared until after there had been a fair accumulation formaldehyde, and it disappeared before the end the experiment, while free oxygen was still in the ·em. The conclusion that such peroxide formation ın accidental rather than a normal and constant ure had been strongly reinforced by the high-pressure dation experiments; for while alcohols, aldehydes, l acids in large quantities had been isolated, no ːe of peroxide had ever been detected. Finally, ·ould be urged against the "peroxidation theory" t in slow combustion of hydrocarbons the most ·tive mixture is not the equimolecular but that in ch the hydrocarbon oxygen ratio is 2 : 1. With higher lrocarbons than those referred to, the more complex he series of changes involved and there is more room side reactions of all kinds, some of which may olve incidental "peroxidation," especially of aldeles: therefore, while rejecting the "peroxide" ory as applied to the main and normal course of hydrocarbon combustion, Prof. Bone by no mean excluded incidental peroxidation of intermediate pro ducts, but as regards "knock," nothing as yet had been really proven.

## THE MECHANICAL TESTING OF BITUMINOUS ROAD MATERIALS

**By F. M. POTTER, O.B.E., F.I.C., M.I.P.T.**

The laboratory examination of the mineral aggregate and of the bituminous binders, tar and bitumen, employed in road-paving mixtures, follows well-tried and *in many cases standard lines. These tests frequently* have little or no relationship to the service conditions to which the materials are to be exposed. Rather are they to be taken as indicators that the material *conforms to a type which in past experience has given* satisfactory road-paving results. Further, any alteration in composition and properties which may take place during the mixing and road laying processes is *not controlled. There has been a steadily growing* opinion that the separate materials having been tested, a further group of tests should be applied to the paving mixture when laying, these tests being designed to demonstrate the *serviceability* of the paving, and being based as far as laboratory conditions permit on an imitation of road service conditions. Attention should be given to the traffic load factor, the effect of frost, moisture, temperature changes, etc.

Investigations on these lines have indeed proceeded for the past 20 years or so. Schmidt and Hermann of the Berlin City Surveyor's laboratory published a brochure on this subject as early as 1915, and Dr. Herrmann has since incorporated a mass of detailed results in his annual reports. Road technicians have long been acquainted with the work of Hubbard in America, of Neumann in Stuttgart, and more recently have read with interest the communications of Vandone and his colleagues from the Italian State Laboratory at Milau.

In this country the first official series of experiments was started at the National Physical Laboratory at the request of the Roads Department, Ministry of Transport in 1912. In 1929 the Ministry erected and staffed its own experimental station at Harmondsworth on the Colnebrook By-Pass Road, the control of which has now passed to the Department of Scientific and Industrial Research. An Advisory Board to advise generally on the conduct of Road Research has been established, Major F. C. Cook being appointed chairman. The work of the experimental station is directed by Dr. Stradling, with Mr. Batson as chief resident officer. The station is to work in close conjunction with the Experimental Branch of the Ministry of Transport under Major Turner.

In the asphalt industry at least two firms have developed a series of mechanical tests to control the properties of their particular products. A number of valuable papers emanating from the laboratory of Highways Construction, Ltd. have been published, and the Limmer & Trinidad Lake Asphalt Co. has developed routine and research methods at its Fulham and Stirling laboratories. The Gas Light & Coke Co.

has recently erected a well-equipped station at its Beckton Works for the investigation of tar-paving mixtures. A further development of interest was the establishment in 1928 of the Chair of Highway Engineering at the Imperial College of Science and Technology, the first and present holder being Prof. R. G. Clements.

It is well known that in addition there is a large amount of private research work bearing directly on this road problem, which has not been published in scientific journals. The literature of the subject is scattered, and it is only during recent years that systematic abstracts have appeared.

An important step in the development of the subject was the appointment by the British Standards Institution Road Materials Committee in 1928 of an *ad hoc* committee to review the then known position and report. This committee suggested collaboration with the Ministry of Transport, and the discussions led to the appointment of a joint committee on which the various interests were represented. This joint committee appointed a panel of workers closely connected with laboratory work to review the published work, and to select tests recommended as being of value in correlating laboratory work with the behaviour of the materials under practical conditions. This committee is still working.

The desired properties in a road are durability, stability, and a safe riding surface, with an economic cost of construction. In the past it has not been possible to report upon a proposed method of bituminous road construction which is free from obvious faults, except by the tedious and costly process of laying a trial section of road and awaiting for the development of signs of failure under uncontrolled weathering and traffic conditions. It will be obvious that if it is possible to develop scientific laboratory tests under controlled conditions, closely imitating predetermined service conditions, but in which the effect of the destructive agents such as weathering and load forces are accelerated, a material advance will be made not only in the control of methods of construction, but in the investigation of proposed methods of improvement. An essential factor is that the laboratory tests shall have been closely correlated with the results of actual road trials, and hence the co-operation of the surveyor is vitally necessary. In the laboratory the chemist, physicist, and engineer will contribute to the solution of the problems.

The early workers naturally used the known work on the strength of materials as a basis for their investigations. Hence tests based on the determining of resistance to compression, bending, tension, impact, and attrition have been suggested and used. Hardness, permeability to water, and power of shock absorption are additional tests that have been employed. The known methods of applying these tests to paving mixtures containing a plastic binder, the factors affecting the results obtained, and their possible values for control and research will be considered in the papers contributed to the forthcoming Road Materials Conference on November 14. Great stress is laid on the importance of the bearing of the many factors which affect the conditions of a road surface during its life, and there is a tendency to break new ground in an endeavour to imitate as closely as possible service conditions.

No single test will be universally applicable as the sole test of the value of a bituminous paving. It will not be possible to incorporate in a single method of examination the effect of such destructive factors as the pounding action of the heavy solid-tyred lorry, the suction action if any of the fast-moving car, the standing load of an omnibus or coal cart, and the varying atmospheric conditions. It may be concluded rather that no one type of mixing will give the maximum resistance to each of the destructive agents and that the formulæ and constructional conditions chosen will be those which yield the highest figure of merit when the several factors appertaining to the particular jobs are allotted their relative importance.

Further, the accepted range of figures for a mixture examined by a particular test will vary with the nature of the aggregate, the binder and the conditions under which it is to be laid. Maxima as well as minima will have to be specified. For example, the same compression strength is not obtained with a cold-process tar macadam, as with a hot-process tar macadam (tar concrete), the first employing a tar of 50—120 sec. viscosity according to the nature of the aggregate and as determined by the standard method, and the latter incorporating a very thick tar of viscosity corresponding to 300 sec. and upwards in the same units; yet both types of material when properly laid have given completely satisfactory road results.

The field for research is vast. There are numerous variants to be studied and their action assessed, but the value of the good safe riding road to the community, and the possibilities of reducing the cost to the taxpayer make the problem one of outstanding importance. No single laboratory can cover the whole field, and an effective solution to the more pressing problems calls for sound team work by the scientific workers of the industries. There is an immense amount of spade work necessary to prepare the foundations, and no road trial can be satisfactorily started until the foundation work has been surveyed and placed well in hand. For this reason it is hoped that the Treasury grants in aid of this work will be commensurate with its importance.

## NOTES FROM INDIA

*Proposed Academy of Science.*—A scheme is on foot in India to found a central authoritative scientific body which would secure efficient co-operation amongst the various Indian research institutions, arrange for publication of important papers, and serve similar useful purposes. An appeal on these lines, signed by 20 eminent men, has been addressed to more than 700 scientists in India.

*Mineral Production in Burma.*—The total value of minerals exported from Burma during 1932 was Rs. 17,88,82,225 (about £14,000,000), as compared with Rs. 12,64,94,512 in the previous year. The principal minerals exported were jade, gold, silver, copper blocks, lead, tin-ore, wolfram-ore, zinc concentrates, and mineral oils of various kinds. There was a marked drop in the exports of gold, copper blocks, pig lead, wolfram-ore, and zinc concentrates. Minerals imported during the year, valued at Rs. 87,55,232, included chalk and lime, clay, coal, and tin.

# SOCIETY OF CHEMICAL INDUSTRY

## OFFICIAL NOTICES

**Annual Chemical Dinner.** November 28, at Hotel Great Central; Chairman—Lord Leverhulme; Chief Guest—Mr. A. P. Herbert. Application for tickets with suitable remittance, should be made as early as possible to Mr. F. A. Greene, Chemical Club, 2, Whitehall Court, London, S.W.1. The price of each ticket, including dinner, gratuities and dance, is 12s. 6d.

**Australasian Subscriptions.** Australasian members, including those in New Zealand, should all have received notice of the necessity to pay the subscription for 1934. This should be done at once in order to ensure the service of the JOURNAL being uninterrupted, but members are reminded that, during the period of depreciated currency, they may pay the subscription direct to the Society's account at the Commercial Bank of Australia, 273, George Street, Sydney. The Bank cannot entertain correspondence on Society's business, but will issue an interim receipt.

**The Ramsay Chemical Dinner** will be held in the Central Hotel, Glasgow, on Friday, December 8. *Reception, 6.45 p.m. Dinner 7 p.m. Dancing till 2 a.m.*

The chair will be occupied by Sir Arthur Huddlestone, C.M.G., O.B.E., M.A., the new Director of the Royal Technical College.

Tickets may be had from the Convenor, Mr. John C. MacCallum, 10, Midlothian Drive, Glasgow, S.1, and applications must be accompanied by the appropriate remittance, 14s. 6d. each. Students' tickets (limited to 20) 10s. 6d.

Those desiring to stay at the hotel overnight may book accommodation direct with the Central Hotel on the specially arranged terms of 10s. 6d. for bed and breakfast.

## BRISTOL SECTION

The second meeting of the session was held jointly with the Institute of Chemistry, in the University Chemical Department, and Mr. R. D. Littlefield presided over an excellent attendance. Mr. G. S. Fawcett, manager of The Tintometer, Ltd., read a paper on "Colour Measurement."

After defining colour as a term used to describe the quality of sensation which is stimulated when light falls upon the eye, light was described by quoting certain passages from Sir William Bragg's book "The Universe of Light." The conditions which affect colour were then considered and the standard sources of illumination specified by the 1931 International Commission were reviewed. The difficulties of obtaining a satisfactory daylight in most industrial areas was also dealt with.

Mr. Fawcett described the events which led his grandfather, the late J. W. Lovibond, to seek for a standard of colour for the brewing industry which eventually resulted in the Lovibond Colour Scale and the Lovibond Tintometer. Colour charts, and forms of Comparator employing columns of liquid of pre-determined composition were then explained, together with additive and subtractive colorimeters. Mr. Fawcett explained that the Guild Colorimeter is the standard instrument at the National Physical Laboratory and is of great value for research work. The Lovibond Colour Scale was then enlarged upon and lantern slides illustrating different forms of the apparatus were shown. The method of determining the hue, saturation, or brightness of the colour under examination was explained, and recent developments in the apparatus were shown by specimens. The Lovibond Tintometer and Comparator were also shown.

An interesting discussion followed and a hearty vote of thanks was passed to Mr. Fawcett.

## EDINBURGH SECTION

A meeting of the Edinburgh Section was held in the North British Station Hotel, Edinburgh, on October 26, at which Mr. Adam Tait delivered his inaugural address on "Science in the Brewing Industry."

In his introductory remarks Mr. Tait said that science was, in his opinion, the best means of obtaining fundamental facts and this was essential if further progress were to be made in the brewing industry. He took as his starting point the epoch-making researches of Pasteur and went on to the work of Kjeldahl on the diastase of malt. He also showed how other workers had utilized Kjeldahl's "Law of proportionality" in general enzymic investigations. He dealt at some length with the practical applications of Sorensen's classical work on hydrogen-ion concentration estimation in brewery control and showed the importance of electrometric titrations in malt extract and beers and how a measure of the potential basicity conld be deduced from the results.

The nitrogen question in brewing is undoubtedly complicated, but the lecturer, though only touching the fringe, pointed out *inter alia* the buffering effect of the complex organic nitrogenous substances which were present in the barley and degraded during the malting and mashing processes. Yeast depends on these degradation products for its reproduction and so it is obvious that its life history is bound up closely with the nitrogenous substances in barley—an opinion held by those responsible for the Institute of Brewing research scheme.

A fair part of the lecturer's address was taken up with the chemistry of hops and he showed how it had been made possible to estimate the preservative power of hops by chemical means and how the hop grower was now in a position to select hops for cultivation which would suit the brewer's requirements. He also made snggestions to chemists for further lines of work which he thought might lead to a more economical use of hops in practice. The "Log Phase Method" of Walker and his collaborators was referred to and the possibility of this method of estimating small differences in antiseptic potency might be extended with advantage to medical researches. The nse of the α acid of hops, comparatively easy to obtain in crystalline form, and being weight for weight about a hundred times as potent as carbolic acid as an antiseptic in certain cases of stomachic indigestion was suggested as a possible aid to the welfare of mankind.

The question of "wild" or "diseased" yeasts and methods for eliminating them was gone into and in a

general summary the lecturer claimed that the present-day brewer with modern plant and stricter laboratory control was better equipped to turn out a regular article of inestimable value to all concerned. In conclusion Mr. Tait said that an alternative title to his address might have been " Brewery Control by a Modern Laboratory " and pleaded for real collaboration between technical and laboratory staffs as the only way to bring the efforts of science to fruition in the brewing industry.

## GLASGOW SECTION

A joint meeting of the Glasgow Sections of the Society and the Institute of Chemistry was held in the Royal Technical College on November 3.

Prof. G. G. Henderson was called to the chair by Prof. Caven, the chairman of the Glasgow Section of the Institute, and introduced Mr. Thomas Ramsay who opened the " Discussion on Commercial Affairs " by giving a short historical outline and review of the work of the Glasgow Chamber of Commerce.

The Glasgow Chamber of Commerce was the first to be established in His Majesty's Dominions, having come into being in 1783. From then until the present day it had seen many changes in the industries of the city but it had always been active in putting right anything which was disadvantageous or acting unfairly towards the industrial welfare of any branch of the community. During the war period the Chamber, in association with the Royal Technical College, had raised a battalion and the results of this combined effort were so great that Mr. Ramsay felt sure that similar co-operation to-day would have a beneficial effect in easing the stress of post-war depression.

Mr. Cree, an ex-president of the Chamber, and Mr. Cameron, the secretary, were present, and both gentlemen expressed the opinion that any suggestions for the improvement or retention of chemical industries in the West of Scotland would receive the most sympathetic attention and warmest support of the Chamber of Commerce.

Prof. Henderson then introduced the subject of the Report on Scottish Chemical Industry recently issued by the Scottish National Development Board and said that, in his opinion, this report represented a very fair picture of the present state of affairs, but any criticisms or suggested improvements would be welcomed.

Mr. Gunn criticized the Report as not being complete, basing his criticism chiefly on the section dealing with textiles. He said that the reason why Glasgow lost this industry was that 40 years ago the Scottish loom operative was only capable of running two looms while the workers in Lancashire could control four looms. The reason for this was that the housing conditions in Lancashire were better than in Glasgow and the workers were thus better able to stand the strain. Bone glue, said Mr. Gunn, had not even been mentioned in the Report although he knew that 100 tons of bones were being sent weekly to the North of England. He would like to see an industrial estate in Scotland run on similar lines to the Trafford Park scheme.

Mr. Peden spoke of the tax on white spirit and turpentine and said that it was conceivable that white spirit might be used in petrol engines but since turpentine could not be used for this purpose he considered that the present tax on the latter material was grossly unfair to the paint manufacturers and asked if the Chamber of Commerce could take steps to have this tax repealed.

Sir Arthur Huddleston said that the Report at first seemed to him to be a statement of facts without any concrete suggestions as to how the chemical industry might be improved. On maturer reflexion, however, he realized that one must have the facts first and the suggestions would follow. Before any new industry could be established in Scotland it was necessary to consider what natural advantages this country possessed and then to investigate how best these advantages could be exploited. It was in this exploitation of these natural advantages that he considered an institution like the Royal Technical College could do most useful work. He then appealed to industrialists to indicate on what lines research could be best instituted.

Prof. Henderson said that he could assure Sir Arthur that there had always existed a sympathetic understanding between industrialists and the Royal Technical College and that industries in the West of Scotland did not suffer from lack of scientific co-operation but from lack of financial backing.

Dr. Hopper said that the Report had been prepared by specialists in the various branches and that they had not been thinking entirely of chemists in drawing up the Report but hoped that it would be of value to readers in general throughout the whole of Scotland. He said that we were now a tariff country and were likely to be so for years to come and this, he thought, ought to bring about a closer union with the Colonies. Scotland could not compete in the English market against long established concerns more suitably placed as regards raw materials and home markets but he felt very hopeful of the Colonial market.

Dr. Gordon asked why the mineral oil industry had been omitted from the Report and said that it was the large importation of petroleum which caused the adverse trade balance.

Prof. Henderson said that the reason for the omission of the mineral oil industry was that coal and industries allied to it were being dealt with by another committee. He concluded the meeting by reminding those present that the Chemistry Committee of the Scottish National Development Board was still in existence and would welcome any further suggestions.

## LONDON SECTION

A joint meeting of the London Section and the Food Group was held on Monday, November 6, at Burlington House, under the chairmanship of Dr. J. J. Fox, assisted by Dr. L. H. Lampitt.

The evening was devoted to the delivery of the Jubilee Memorial Lecture by Dr. Lampitt, whose subject was " Some Fundamental Scientific Problems of the Food Industry."

The vote of thanks, proposed by Dr. Dyer and seconded by Sir Robert Robertson, was warmly supported by the large audience present.

As the lecture will be delivered on two future occasions no publication of it is possible at the moment.

## MANCHESTER SECTION

The annual conjoint meeting of the Manchester sections of the Society of Chemical Industry, the Institute of Chemistry, the Society of Dyers and Colourists, and of the Manchester Literary and Philosophical Society was held at the College of Technology on November 3; Dr. A. Schedler, the chairman of the ocal section of the Society of Chemical Industry, residing.

Sir Robert Robertson, K.B.E., F.R.S., gave an address on "Research in the Infra-Red," introducing he subject by explaining the position of the infra-red elative to the other regions of the spectrum. After liscussing theoretical points, apparatus, and technique, Sir Robert described how infra-red rays had been pplied to the elucidation of many problems, including tomic and molecular structure, the photographic ecording of distant objects, the detection of erased ancellation marks on stamps, and the detection of ertain pathological conditions, notably the disclosure f varicose veins which could not be observed by the aked eye. In referring to the exploration of the ossibilities of the infra-red for determining the most uitable dyestuffs for fabrics to be worn in the tropics, Sir Robert expressed the opinion that satisfactory esults in this field of investigation would not be achieved ntil research was carried out in a region of the spectrum urther from the visible. As a therapeutic agent, he emarked that infra-red radiation might prove valuable, ut much fundamental work would be necessary before ts efficacy could be established.

The address, which was illustrated by diagrams and antern slides, was much appreciated by a large audience.

## YORKSHIRE SECTION

At the first meeting of the session of the Yorkshire ection of the Society held in the New Chemistry heatre of the University of Leeds on Monday, October 30, Dr. Ulick R. Evans delivered a lecture on "Corrosion and Protection," a summary of which ollows.

High-temperature oxidation, said Dr. Evans, commences rapidly, but, except for metals like magnesium with porous oxide-films, falls off as the oxide-film hickens: many alloys containing chromium or aluminium, which give a film impervious when relatively hin, withstand very high temperatures. Iron, copper, nd nickel, when gently heated, show splendid interference tints as a result of the thin films on the surface, ut the oxide-film produced by exposure to air at ordinary temperature is normally invisible: when stripped rom the metallic surface, however, it becomes quite isible.

Low-temperature corrosion can occur to some extent ven when pure water containing oxygen acts on metal, ut the low solubility of most oxides or hydroxides imits the attack. When salts are present, and an lectric current flows between one part of the metal nd another, the initial products are usually freely oluble, and therefore electro-chemical corrosion is t low temperatures far more important than direct oxidation. The currents may be connected with local differences (*a*) in the metal or (*b*) in the film upon it or (*c*) in the water (*e.g.*, the oxygen supply may vary from one part to another). The distribution of attack varies greatly with the conditions. In the case of iron half immersed in salt solution, or carrying drops of salt water, the first distribution depends largely on the state of repair of the invisible oxide-skin, but usually this quickly passes into a second distribution connected with the supply of oxygen; at this stage the corrosion-velocity can be calculated from purely electrical measurements, and the good agreement with the observed velocities confirms the electrochemical character of the process.

Anaerobic corrosion (in oxygen-free waters) depends largely on a low $p_H$ value in the water and the presence of spots of low overpotential from which hydrogen can be evolved. Atmospheric corrosion only becomes rapid if the humidity exceeds a certain critical value, which depends on the hygroscopic character of the corrosion products.

Protection against corrosion may be based on the following:

(1) *Use of resistant materials.*—Here alloys of chromium and aluminium which give resistant, self-healing films are of special value, but they tend to suffer attack where freshly cut, especially in presence of chlorides.

(2) *Water-treatment*: many natural waters containing calcium bicarbonate deposit a chalky film which sometimes stops the corrosion-process. If excess carbonic acid is present, it should be neutralized by alkali dosage; after a slight chalky deposit has formed, it may be best to adjust the dosage so that the water deposits no further chalk, but does not dissolve that already deposited. Excessive dosage may cause blockage of pipes with chalk. In the absence of calcium iron can remain bright indefinitely in water treated with sodium hydroxide, phosphate, or chromate, but if chlorides are present the dosage must be increased; insufficient dosage causes intensification of attack by confining corrosion to small areas.

(3) *Metallic layers*, including (*a*) cathodic metals, like nickel or copper, the layers of which require to be continuous if attack is to be avoided; (*b*) anodic metals, like zinc or aluminium, which in some circumstances can for a time give "sacrificial" protection even at a gap of the coat. For some purposes aluminium may be more efficient than zinc, whilst for others the reverse is true.

(4) *Paint coats*, including (*a*) those which exclude mechanically and require to be water-tight (*e.g.*, iron oxide paints; (*b*) those which inhibit corrosion processes chemically and are not necessarily water-tight, *e.g.*, red-lead paints. In general, paints of class (*b*) are used in the bottom coat, covered by paints of class (*a*).

The interest aroused by the lecture stimulated a long discussion, contributors to which included Profs. Comber and Cobb, Messrs. Bain, Goodson, Hodsman, Jarvis, Kitchen, Parrish, and Wood. Replying to questions, Dr. Evans said that personally he had made no definite experiments on the corrosion due to dusts of various compositions settling on steel, but referred to the work

of Dr. Vernon. Commercial processes for the deoxidation of water were used to some extent in the treatment of boiler water. Concentrated alkali had a distinct corrosive action on copper and brass, and, at high temperatures, on steel. Sodium phosphate, rather than sodium carbonate, should be employed to treat water for high-pressure boilers: sodium hydroxide derived from sodium carbonate tended to give rise to caustic embrittlement of the steel. Glycerine was not known to him as an anti-oxidant: phenol certainly attacked metal and its presence was often responsible for the corrosion of metal below tar coats. Where metals resistant to attack by sulphuric acid were required, the use of molybdenum alloys appeared hopeful.

With regard to the dependence of rusting on the passage of oxygen into stagnant water, the gas could be introduced in several ways, namely, by free diffusion, by thermal convection caused by non-uniformity of temperature, or by "Adeney streaming," in which a current of unsaturated air passing over stagnant water containing salts caused evaporation and, consequently, an increased concentration at the surface layer, which descended carrying oxygen with it. The rate of corrosive action at low temperatures was very often accelerated by the presence of a film of moisture, such as might be produced by a fall of temperature below the dew-point; at high temperatures, condensation of water was not usually necessary for corrosion to occur. The failure of attempts to preserve passive iron by hermetically sealing it in concentrated nitric acid, although it could be kept unchanged in dichromate solution, was due to the marked instability of the passive film produced by nitric acid. He had had no practical experience of the process of "aluminizing" for the prevention of heat corrosion, but believed it to be of great utility under certain conditions.

## FOOD GROUP

The first meeting of the Food Group of the Society in the 1933—34 session took the form of a joint discussion with the Physiological Society on October 20. The meeting was held at the London School of Hygiene and Tropical Medicine, with Dr. L. H. Lampitt, chairman of the Group, presiding, and the following took part in the discussion: Prof. H. E. Armstrong, Mr. A. L. Bacharach, Prof. S. J. Cowell, Prof. J. C. Drummond, Dr. M. W. Goldblatt, Dr. R. D. Lawrence, Dr. A. S. Parkes, Dr. G. L. Peskett. Two of the contributions are given below.

Prof. H. E. Armstrong said:

We cannot but agree that we are at the beginning of a new era. Far from world progress coming to an end in 1933, as Mr. Wells in his lack of wordly knowledge and vision would suggest, we can foresee that we shall shortly be able to feed it forward and onward to health: though we shall surely die, if current and increasing malpractice in feeding be not stayed. Still, we are but at the beginning of our work and must be sober and wise in our judgments, ever cautious in the advice we give. In practice, the problem of food supply is beset with difficulty: the conflict with ignorance and commercial greed is bound to be serious. There is danger even that scientific service may be tainted by industrial commitments. Something must be done to stay the issue of false advertisement: the publicity agent in his ignorance will assert anything; he is fast becoming one of the most serious of social dangers [Sometimes he lets us behind the scenes—for instance, in the cryptic appeal of *Bovril* for autumn leaves, now rushed about everywhere. Few of us have thought of it as an extract of plant material, nor have we hitherto connected it with chlorophyll, which advertisement also asserts is a cure for every ill. It is the turn of the cabbage to be boomed.] To take an example. The brewers, most unfortunately, are embarking on a *More Beer* campaign. In my view, once it be whispered abroad that a beer worth drinking is to be had, there will be no need of advertisement. Having an affectio[n] for beer, I have been sorely surprised by the followin[g] misleading statement in the *Sunday Times* (Oct. 15) "BASS maintains summer health throughout winte[r] months. BASS is *nature's* tonic. You need no othe[r] If you are out of condition, the vital ingredients i[n] BASS 'tone' your system, purify your blood, and nouris[h] your tissues, putting you 'on your toes' in a matt[er] of days. If you are well, drink BASS to *keep* you wel[l] It is the most enjoyable—and best—winter drink. Nothing could be in worse taste nor less "scientific. What are the *vital natural ingredients* in BASS other tha[n] water? Has the firm no longer a scientific departme[nt] to guide its commercial policy? Advocate as I alwa[ys] have been of beer, as "the one safe drink the wor[ld] over," I cannot stomach such false appraisement of i[ts] virtues.

My own opinion is that all such advertisement mu[st] be stayed—that we should allow no false foods to [be] poster'd into our stomachs, no "vitamin" temptatio[n] to be offered to housewives, who can have no sense [of] balance in their use. So much by way of clearing t[he] ground of wrong things. What of the right? The[y] be few and far between. Present-day bread, we kno[w] cannot be the staff of life. There is more than enou[gh] butter produced and producible without resorting [to] manufactured, nickelised, hydrogenised fats. Whi[le] here and there good milk is to be found, the avera[ge] quality is much below what it might and should [be]. Eggs from the barn-door fowl, fed on grass and worms a completely natural diet unspoilt by cooking—a[re] worth eating: those produced under the present-d[ay] preposterous system of forced, unnatural feeding [are] fast losing the character of eggs. The adage "eggs [are] eggs" no longer holds: they rarely are. We ha[ve] no proper supply of fresh vegetables. Now the *Tin A[ge]* is upon us; 1933 will be the year of our downf[all] if we continue to live on thus.

Turning to the hopeful side, may we not ass[ert] without fear of contradiction, that if we can once le[arn] to feed ourselves properly we are assured of healt[h]. Twice this year, at Nottingham and recently at the op[en]ing of the Session of the Pharmaceutical Society, I h[ave] discussed the case of Manufactured *v.* Natural Dr[ugs] and have foreshadowed the ultimate victory of the lat[ter]. I have asserted that we now know that "man lives [not by] drugs alone": the *Advitants*, as I will continue to [call] them—whether the endocrine secretions or those pre[...]

in food materials. Hence my advice to the druggists to undertake the sale of fresh green vegetables. The general verdict of physiological opinion must be to such effect. I would rest my case especially upon Sir Robert McCarrison's observations (see B.M.J., June 6, 1931; Oct. 14, 1931), which are remarkable, both on account of their extent and the prolonged, systematic character of his inquiries. Rats in large numbers can be so fed, over long periods, that they remain entirely healthy: if there be any departure from the recognised proper diet or the housing conditions be unsatisfactory, disease *is at once apparent.* I am now brought to my chief point of departure. If rats can be so fed and housed that they remain healthy, why not cows? This is the one and only chance that I see of eradicating tubercular disease: a real chance, however.

Our treatment of the cow is wicked—only the fowl is worse off. We make of it a mere milk-making machine: milk it mechanically and treat its milk mechanically. What is milk worth to the infantile stomach? So ignorant are we as chemists that we cannot say what it is or what it might be. Our knowledge of milk is entirely superficial and so it is of every other food material! The constituents we have characterised are only those which have more or less striking properties. The four lactoflavins recently isolated in minute proportions have been "spotted" because they happen to fluoresce in ultraviolet light. There may be dozens of more modest ingredients. To repeat, we have everything to learn of milk and of all our foods.

We may have exaggerated the value of milk, even human. Is it a complete food? We recognise the need of adding orange juice to cow's milk given to infants. I hear of spinach being regularly administered to a great-grandchild in California. Does not the young calf, the young lamb, begin to nibble grass at a very early stage and so supplement the mother's milk? Did not primitive woman, seeing all animals eat it, give her infant grass to suck? The modern fashionable woman and the medical profession have lost the art of infant feeding but the masses are better advised—as they say, "them have's what we have's." I have seen French mothers give their infants spoonfuls of beer and even of wine. Sir Thomas Barlow, fifty years ago, showed that the children of the well-to-do were too carefully fed and therefore starved. My son came to a similar conclusion recently at a popular seaside resort in the United States: the children with nurses had poor legs and limbs.

Finally, we come to grass. Grass was worse treated than the cow is, up to the late war, when the Germans began to feed it with nitrogen and to use it young. The experiments have been taken up here, under the direction of Sir Frederick Keeble, at the I.C.I. Agricultural Station at Jealott's Hill. There it has been proved to demonstration that grass, like every other cereal, needs cultivation. Cultivated and supplied with all necessary mineral fertilisers *and nitrogen, at right times and in proper balance,* fed young to stock, it is far superior in value to ordinary grass. Most important of all, young grass cut in summer and properly dried forthwith can be fed to cattle during the winter and produce summer milk in appearance as judged by its colour and by the butter made from it. Moreover, such grass is a superior diet for the cattle.

Desiring to carry the experiment further, last winter, I arranged for a similar trial to be made during the winter and spring terms at Christ's Hospital School. Certain cows were set apart and fed on the dried summer grass, whilst the rest of the herd had the ordinary good dairy ration. The milks were collected apart. Two sets of the youngest boys were picked out: one had a glass daily of the ordinary milk, the other of the "dried-grass" milk. It is too early to speak of the boys; *the effect upon the cows was magical and a complete* confirmation of the Jealott's Hill results. Nebuchadnezzar may not have been so badly fed after all. The difficulty will be to get assured supplies of such grass and to reduce drying to an economic proposition. I am hopeful and see no reason why the summer health of our cows should not be maintained throughout the winter months by grass, not by BASS. We have now to institute organised study of the problems food presents. The task is beyond academic resources.

An immense undertaking is before us—to awaken the Ministries of Agriculture and Health and officer them with the intelligence needed to institute full inquiry, without delay, into all matters relating to the production and supply of whole foods. It would help us much if the Royal Society were to awaken from its academic lethargy and play a constructive hand in public affairs: I fear this is not likely, even with a Wellsian debacle in sight.

## SHOULD PHYSIOLOGISTS TELL

Mr. A. L. Bacharach said:

I think it is occasionally said, and much more frequently felt, by physiologists, that chemists in general, and food chemists in particular, are lamentably ignorant of physiology. I have no intention of countering this accusation by asking whether all physiologists have a sound knowledge of chemistry. I would prefer to direct my observations this evening to another point. When the physiologists tell the chemists that they know too little physiology, I think the chemist might well give the retort courteous of a simple *tu quoque*!

I have recently been very much impressed by this point, because I have recently read the latest edition of Dr. Robert Hutchison's "Food and the Principles of Dietetics," a classical work that will, I imagine, henceforth be known as "Hutchison and Mottram." Dr. Hutchison himself, besides being one of the leading dieticians in the world, is certainly the most eminent British expert on general nutritional problems; as a medical man, however, he is hardly likely to be biased in favour of the chemist and against the physiologist. Prof. Mottram also, after passing through one of the purest schools of pure physiology in the world, should hardly have a chemical bias. Yet one impression stands out very strongly amongst a host gathered from their book. It is the extent and the precision of the chemical information in it, and the very large number of physiological problems to which there appear to be at present no definite answers. When we remember that the authors will naturally have sought their information more in medical and physiological journals than in the

purely chemical and analytical, we may well conceive that the greater definiteness of its chemical information might be still further enhanced were an exhaustive search to be made of the journals devoted to food chemistry.

As it is, the book is replete with analyses. Though the figures show a wide, in some cases, a very wide, range of values for the percentages of different constituents in natural foodstuffs, we can be confident that the figures actually given are pretty accurate as well as definite. The food chemist, having these figures at his disposal, is expected to apply them with physiological intelligence to the product he handles. He wishes to know, for example, what should be the relative proportions in an artificial food, of fat, protein, and carbohydrate. He seeks for information as to what vitamins and what minerals, especially the trace metals, are essential to human nutrition, both infant and adult. In order that his labels and his sales-literature may be correct, he desires to know quantitatively how much of these various ingredients are necessary for the average consumer. I think it will have to be acknowledged that on some of these matters, and on many others, he asks the physiologist in vain for enlightenment. The physiologist, who is doubtless as enthusiastic about the proper feeding of mankind as is the chemist, can only refuse to answer for one reason; he does not know.

I open Hutchison and Mottram at random, at page 59, and in the next 24 pages I find no less than eight matters, of varying degrees of importance, about which the authors find themselves unable to make definite statements. On page 59, after a brief summary of Hill's work on muscle physiology, the authors say "We still await the reconciliation of the discoveries of those who work on isolated muscles with those who investigate what happens in the intact body." On page 61, after discussing the most suitable diet for men undergoing athletic training, the authors say "At present we have to admit that there is a sharp division between the theory of the dietitian and the practice of the rowing man, and that each side remains unimpressed by the arguments of the other."

On page 63 they quote the conclusion of Grafe, who stated, in reviewing work on the relation between metabolism and mental work, that the latter probably has a positive influence on the former, but that so far there are too few experimental data to warrant a definite conclusion. On page 64 the authors write "Whether an abundant supply of protein has, *per se*, an actually stimulating influence on the brain must be left undecided, though such a view is not without its supporters." On pages 66 and 67 is a discussion of the calorific requirements of men, women, and children at various ages. Even on so fundamental a subject as this the authors are constrained to write of Cathcart and Murray's figures, "that these figures are an improvement on Lusk's is theoretically true, but it is also theoretically true that they are far from perfect." Further on they write "For the present it is best, bearing the criticisms made above in mind, to utilise Cathcart and Murray's figures."

On page 77 the authors think it necessary to display an open mind on the vexed question whether excess protein leads to the ills often ascribed to it—nephritis, high arterial tension, gout, and rheumatism. On page 81 the authors raise a further question to which they are unable to give any definite answer, whether in fact the impaired digestive power resulting from town life may not cause the town worker to "be incapable of digesting enough food to keep him in an ideal state of physical efficiency." A few pages further on (page 93) the authors set out mutually exclusive views on the relative digestibility of mutton and beef.

Here we have one unknown to every three pages. This average is certainly not maintained throughout the six hundred pages of the book, much of which is definitely chemical and chemically definite. But there are plenty more examples. I would merely add some comments on two other matters, not specifically referred to in their book.

The first is raised in a recent letter to the British Medical Journal from Dr. G. C. M. M'Gonigle, M.O.H. for Stockton-on-Tees. Dr. M'Gonigle has interested himself in nutritional problems for years, and is, I believe, secretary of the committee appointed a few months ago by the B.M.A. to report on satisfactory dietary minimum requirements. In this letter, Dr. M'Gonigle points out with considerable emphasis that all nutritional investigations are crippled *ab initio* by the absence of any accepted standards of nutrition or criteria of malnutrition.

The second is the problem, or problems, of fat metabolism. I believe it is a commonplace in physiology that 40% of the fat taken into the body by the mouth is not merely not absorbed, but is simply completely unaccounted for. I wonder what physiologists would have to say about a chemist who reported an analysis that only added up to 60%. The whole subject of fat metabolism is clearly of fundamental importance to the food chemist, and there is no doubt that it has excited the interest and exercised the ingenuity of physiologists for generations. Yet we find, if we look into recent literature, that some of the most fundamental facts about fat absorption are apparently quite unknown.

In their excellent book "Human Physiology," Winton and Bayliss give the conventional account of fat digestion. The fat is said to be broken down in the duodenum by the lipase in the pancreatic juice. This leads to the formation of soaps, which duly pass through the mucosa of the lower part of the intestine, their fatty acids being subsequently resynthesized into fats before passing into circulation. We are told to-day, however, by physiologists no less distinguished than Winton and Bayliss that this whole story is completely untrue. Lipase, it is said, plays practically no part in fat absorption. The fat is emulsified and passes through the alimentary mucosa as a mixture of unchanged glycerides. Foreign fats so ingested are actually deposited *as such* in the various fat stores of the body.

Synthesis of the body fat of the eater must, in that case, take place subsequently to the release of fat from storage, and not prior to its deposition. Since fats carry in their unsaponifiable matter some substances of the greatest physiological importance, it becomes a practical necessity to know whether this

unsaponifiable matter is released in the alimentary canal or not. If it is, these important constituents may then be free to pass to whatever part of the body is the site of their specific activity. But if these active substances are not released at all until fats are withdrawn from storage, it is quite conceivable that a body might store, *for example, large amounts of vitamin-A in the* unchanged food fat deposited in the liver and elsewhere, without being actually able to make use of the vitamin-*A* there, owing to some breakdown at the catabolic stage. This purely hypothetical, but quite conceivable, state of affairs would invalidate many conclusions that have been drawn about normal requirement of vitamin-*A*, which would seem to be of some importance alike to physiologists and chemists.

I have tried to show that, from the chemists' point of view, there appear to be important lacunæ in that physiological knowledge they are so often exhorted to absorb. I do not wish it for one moment to be thought that I look with anything but admiration on either the academic researches of pure physiologists (or, indeed of any other scientific workers), or on the many valuable applications of their results that have been made to human affairs. I only wish to urge that, from the point of view of the food chemist, the physiologists have not always delivered all the goods, and that any occasion that brings these two important scientific groups together is to be welcomed mainly in so far as it opens up possibilities of increasing co-operation on the experimental side. I have tried to give instances showing how badly this co-operation is needed and that physiologists are hardly justified in accusing food chemists of ignoring physiological science. Rather should they remember that people who work in glass *thermostats should not throw bricks.*

Some remarks made by Prof. H. E. Armstrong at this meeting do not differ greatly in purport from a recent address delivered by him to pharmacists or from some observations offered by him to the Food Group itself at its Manchester meeting in January last.

It appears that in matters of diet Prof. Armstrong is more loyalist than the king, in other words, more vitalist than the physiologist, some would say, more obscurantist *than the medicine-man.* He appears to believe in what I once heard called "a sort of a something." This is apparently present in all fresh foods and in no processed ones. It has, moreover, mysterious properties of magnetism, so that all of us are drawn towards it and thus earn dietetic salvation from the hell of foods devoid of this divine essence. Even infants in arms "instinctively" know what food to choose: this certainly suggests a new method of filling chairs of dietetics and reducing the average age of professors.

Prof. Armstrong is able to believe whole-heartedly in this "instinct," doubtless to some extent because, as is clear from some of his remarks, he is not well acquainted with the highly interesting recent work on the matter actually reported in the Proceedings of a Society of which he is a distinguished fellow.

I am the last person in the world to decry good cooking, but I cannot for that reason count myself one of Prof. Armstrong's disciples. For then I should have to believe that quite inferior food, far from fresh, provided it were only cooked, in however obscure and sordid a kitchen, by someone with a black beard, a white hat, and a French accent, must be superior as a source of the mysterious "something" to the very finest produce, grown and selected by agronomic experts, cleaned and *tinned under the supervision of expert engineers and* chemists, tested and assayed by qualified bacteriologists and biochemists. Frankly, I cannot accept such a proposition. To approve of good cooking does not involve condemnation of good canning. The best tinned tomatoes are *not* inferior to the worst untinned ones.

If Prof. Armstrong, in his admirable endeavour to keep us all from mental stagnation, puts forward views that can at best only make the physiologists think he must be a chemist and the chemist that he must have become a physiologist, I suppose we must all be grateful to him. Yet it is strange that he, of all men, should express views that seem to illustrate so well the observation of Stéfansson, a practical as well as a theoretical dietitian, that "Unless it be religion, there is no field of human thought where sentiment and prejudice take the place of sound knowledge and logical thinking so completely as in dietetics."

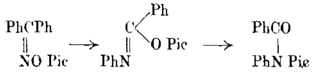
## CHEMICAL SOCIETY

The President, Prof. G. T. Morgan, O.B.E., F.R.S., occupied the chair at an ordinary scientific meeting held on November 2. The following were elected Honorary Fellows of the Society: Prof. A. Béhal, Prof. E. C. Franklin, Sir Frederick G. Hopkins, Pres.R.S., Prof. C. Matignon, Sir Prafulla Chandra Rây, Prof. F. A. H. Schreinemakers, and Prof. Dr. A. Windaus.

*Dr. A. W. Chapman discussed:*

*Studies of the Beckmann Change. Part I. The Spontaneous Rearrangement of Oxime Picryl Ethers.* [With C. C. Howis.]

The rearrangement of the picryl ethers of benzophenoneoxime (I) and related compounds has been studied. When heated, these compounds isomerise into the corresponding acylpicrylanilines (III) the iminoether (II) being doubtless formed at an intermediate stage.



I II III

(Pic = Picryl)

*The rearrangement follows a unimolecular course,* proceeds to completion, and gives a pure product. Rearrangements of the picryl ethers of stereoisomeric oximes yield products corresponding with those obtained from the oximes themselves by the usual Beckmann reagents.

The velocities of rearrangement of two oxime picryl ethers have been studied in detail. The transformation does not depend on traces of an external catalyst nor upon the action of light. The rate of change, however,

is greatly affected by the polar character of the solvent, the relative velocities being in the order

$$CCl_4 < C_6H_6 < CHCl_3 < C_2H_4Cl_2 < CH_3CN.$$

A suggestion as to the mechanism of this rearrangement is made and the relationship between the Beckmann transformation and the Wagner-Meerwein change is discussed.

Dr. O. L. Brady said that the authors had discovered a class of compounds which underwent the Beckmann change without the intervention of another reagent to give pure products, and further, that they had obtained stereoisomerides which also gave pure products on rearrangement, whereas in the rearrangement of the stereoisomeric ketoximes the unstable isomeride always gave a mixture of products owing to isomerisation of the oxime during the reaction. Many interested in oxime chemistry were naturally attracted to the study of the Beckmann change, but, like the speaker, were deterred from any attempt at a quantitative investigation by the experimental difficulties.

In the published paper the authors stated that the picryl derivatives conformed to the condition laid down by Brady and Dunn that compounds undergoing a Beckmann change must be salt-like in character. He was of opinion that in view of the authors' work this postulate no longer held. The idea in the mind of Mr. Dunn and himself at the time was that the rearrangement was due to the weak nature of the bond between the hydroxyl and nitrogen in the oxime salt owing to the tendency of the so-called quinquevalent nitrogen to revert to the tervalent state. On electronic theories much the same idea could be applied to the present case: the bond joining the O Pic residue to the nitrogen would be weakened by the electron attraction of the trinitrophenyl group. Recently he had been working on this idea in connexion with the elimination of acid from acyl derivatives of the aldoximes to give nitriles. One other point was that Dr. Chapman and Mr. Howis' results had confirmed a suspicion he had had that the configurations he and his co-workers had assigned to the picryl and dinitrophenyl ethers of aldoximes were incorrect; they had shown that, in ketoximes at least, no change of configuration takes place in the formation of picryl ethers.

Mr. T. W. J. Taylor spoke.

Prof. R. Robinson concurred in the view that the underlying mechanisms of the Beckmann and Wagner-Meerwein transformations should present points of analogy. In both cases an anion or anionoid complex is transferred to a new position in the molecule, and in both cases there is a consequent rearrangement affecting the atoms between the old and the new sites. The idea of atoms or groups slipping from one position to another is one that organic chemists have come to regard without undue trepidation, and which they may have to recognise in unexpected cases. Lord Rutherford has recently indicated that heavy hydrogen reacts with water, and it will be of the greatest interest to extend this method so as to determine the stability of the C–H bond in hydrocarbons and their substituted derivatives. It will give a new measure of the lability of hydrogen in various states of combination.

Dr. R. G. W. Norrish discussed:

*Primary Photochemical Processes. Part III. The Absorption Spectrum and Photochemical Decomposition of Ketene.* [With H. G. Crone and (Miss) O. Saltmarsh.]

(1) The photochemical decomposition of monomeric ketene vapour occurs in light of the mercury lamp. The products are two volumes of carbon monoxide and one of ethylene.

(2) The absorption spectrum of ketene vapour consists of a series of completely diffuse bands, occurring fairly regularly between 3700 and 2600 Å., the region of maximum absorption occurring round 3100 Å. A second region showing continuous absorption begins at 2200 Å.

(3) The primary change is simply interpreted as a splitting of the molecule at the olefinic bond, according to the equation:

$$CH_2{:}CO + h\nu = CH_2 + CO;$$

the liberated $CH_2$ molecules reacting further with undecomposed ketene give ethylene and carbon monoxide:

$$CH_2{:}CO + CH_2 = C_2H_4 + CO.$$

(4) The character of the spectrum suggests that light is first absorbed by the carbonyl group, and that an energy switch occurs to the olefinic group with the consequent rupture of the molecule.

(5) The energy relationships of the primary change when analysed show that it cannot be represented purely as a rupture of the olefinic bond; they are, however, consistent with a decomposition into $CH_2$ and CO molecules, each containing carbon in the bivalent form. It is suggested that the decomposition can be simply visualised as taking place in one act by a rearrangement of the electrons constituting the olefinic bond.

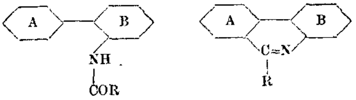
(6) The photochemical change is further discussed in terms of conventional potential energy diagrams.

Dr. J. G. A. Griffiths and Mr. C. F. Goodeve spoke briefly; Dr. Norrish replied.

Dr. L. P. Walls described:

*Researches in the Phenanthridine Series. Part III. Meso-substituted derivatives.*

A brief résumé will be given of the results so far obtained in the conversion of acyl-*o*-xenylamines into phenanthridine derivatives (see also J., 1931, 2447; 1932, 2225).




Rings A and B may be substituted.

The reaction will be considered from the point of view of aromatic substitution, and certain anomalies will be indicated.

The methyl group of 9-methylphenanthridine has been shown to be reactive, and a condensation product

was obtained with formaldehyde. This substance was oxidised to phenanthridine-9-carboxylic acid, and the ethyl ester derived from the latter proved to be identical with the ester obtained in small yield from ethyl *o*-xenyloxamate and phosphorus oxychloride. The conversion of *o*-xenyloxamic acid into phenanthridine derivatives by the general process followed an unexpected course, and in the former case not phenanthridine-9-carboxylic acid, but, among other products, a diphenanthridone was obtained.

By the condensation of 9-chlorophenanthridine and aliphatic diamines, for the preparation of which improved methods have been devised, derivatives analogous to the new antimalarial "atebrin" have been obtained. Variously substituted derivatives of 9-chlorophenanthridine have been prepared from corresponding phenanthridones which are easily derived from fluorenone derivatives, or by oxidation of 9-methylphenanthridines.

The results of therapeutic tests of phenanthridine derivatives will be reviewed, and a general résumé of the chemotherapy of the series will be presented, particularly in its relationship to analogous acridine derivatives.

Dr. E. E. Turner remarked that certain 2′: 6-disubstituted-2-acylamidodiphenyls should be incapable of undergoing closure to a phenanthridine if the 2′ and 6 groups in these instances were unable to pass each other in space. He also referred to another possible route to phenanthridine-9-carboxylic acid:

$$\cdot CMe{:}N\cdot \rightarrow \cdot C\cdot CCl_3{:}N\cdot \rightarrow \cdot C(CO_2H){:}N\cdot$$

In connexion with the difficulty of preparing *o*-aminodiphenyls for conversion into phenanthridones, Dr. J. M. Gulland recalled that during the investigation of the constitution of thebenine Dr. Virden and he had observed the formation of 3 : 8-dimethoxythebenidine—a benzophenanthridine—in the dehydration of 5-aldehydo-3 : 4 : 8-trimethoxyphenanthrene oxime. A transformation analogous to this and to Bamberger and Goldschmidt's synthesis of *iso*quinoline from cinnamaldoxime might be achieved by using the oximes of suitably substituted 2-aldehydodiphenyls.

In reply to Prof. J. L. Simonsen, Dr. Walls said that thionyl chloride had not been tried except in cases where phosphorus oxychloride had failed, and here it failed also.

Dr. H. King pointed out that the three recognised antimalarials, quinine, plasmochin, and atebrin could be regarded as 6-methoxyquinolines substituted in the 4- or 8-positions by strongly basic side-chains. It was of interest that quinine and atebrin which are said to act on the same stage of development of the plasmodial parasite were both 4-substituted quinolines whereas plasmochin which was an 8-substitnted derivative acted on a different stage of the parasite. Phenanthridine was a 3 : 4-benzquinoline and Dr. Walls had definitely established absence of antimalarial activity with basic side-chains in the 9-position. Atebrin could be regarded as a 2 : 3-benzquinoline derivative with a basic side-chain in the 4-position of the quinoline nucleus but imitation of atebrin in phenanthridine was impossible. Antimalarial activity might however now be expected to appear by introduction of a basic side-chain in the 8-position analogous to plasmochin.

The President mentioned that within the present year phenanthridine had been isolated from the anthracene oil of coal tar by Sielisch and Sandke (Ber., 1933, 66, 433) so that we now had two similar pairs of tar products, anthracene and acridine, phenanthrene and phenanthridine, a base corresponding with each hydrocarbon. This discovery lends additional interest to the research described by Dr. Walls.

Mr. A. E. J. Pettet discussed:

*Homologues of Phenol.* [With G. T. Morgan.]

Consecutive *pseudo*cumenol ($CH_3 : CH_3 : CH_3 : OH = 1 : 2 : 4 : 3$), the only hitherto unknown polymethylphenol, has been prepared by suitable methods from the corresponding nitro*pseudo*cumene, which was obtained either from trinitro*pseudo*cumene by elimination of two nitro-groups, or from dinitro*pseudo*cumidine by removal of the amino-radical and one nitro-group.

3-Methyl-5-ethylphenol has been synthesised by the following series of reactions:—*o*-toluidine ⟶ 2-methyl-4-ethylaniline ⟶ 2-methyl-4-ethyl-6-nitroaniline ⟶ 3-methyl-5-ethylnitrobenzene ⟶ 3-methyl-5-ethylaniline ⟶ 3-methyl-5-ethylphenol.

Other isomeric methylethylphenols have been prepared by similar methods.

The President exhibited two slides showing chemical substances isolated from low-temperature tars and their aqueous liquors as the result of eight years' research at the Teddington Laboratory. Among these products the homologues of phenol occupy an important position and the researches described by Mr. Pettet were undertaken not only to extend our scientific knowledge of such higher phenols bnt also to obtain authentic specimens with which to compare phenolic products isolated from commercial tars.

Mr. C. Chapman asked whether an investigation had been made into the bactericidal power or the reactivity with formaldehyde of the methylethylphenols, and whether the presence of the ethyl group increased or decreased the wetting power.

Dr. Pettet replied that the phenols were being synthesised exclusively with the object of studying their properties.

## SOCIETY OF PUBLIC ANALYSTS

An ordinary meeting of the society was held at the Chemical Society's Rooms, Burlington House, on November 1, the president, Mr. F. W. F. Arnand, being in the chair. The following were elected members: H. G. Coles, A. F. Colson, C. A. Dunbar-Mitchell, A. D. Husband, G. V. James, J. B. McKean, J. G. Peirce, J. Rae, V. Venkatachalam, A. M. Ward.

The evening was devoted to a discussion on "The Chemical (as distinct from Physiological) Tests for Vitamins."

Mr. A. L. Bacharach, in opening the discussion, first considered the general analytical principles involved in the determination of vitamins and similar "trace" substances. He outlined the present state of knowledge of the chemistry of the individual vitamins. He

enumerated such chemical tests as had been used or suggested for the estimation of vitamins, of which the two most important were the Tillmans-Harris test for ascorbic acid (vitamin-*C*) and the antimony trichloride test for vitamin-*A*. The former he left to be discussed by Dr. Harris himself, and summarized the present state of knowledge of the vitamin-*A* test. After pointing out the limitations of the test, and the difficulties involved in its interpretation, he concluded by emphasizing its great practical importance, especially to manufacturers of vitamin-*A* concentrates.

Dr. Leslie Harris, discussing the most accurate methods of applying the antimony trichloride test for vitamin-*A*, said that for quantitative work it was essential to saponify the oil, substances interfering with the production of the blue colour being removed by hydrolysis. For vitamin-*C* a quantitative method based on the use of Tillman's indophenol indicator had been made more nearly specific by a preliminary removal of interfering reducing substances. Although in exceptional cases (*e.g.*, malt extract) the method broke down, yet it was of value in exploratory work. Vitamin-*C* had thus been detected in many unexpected places, such as the lens of the eye, and the findings had been confirmed biologically.

Prof. J. C. Drummond directed attention to certain defects in the B.P. procedure for the antimony trichloride test. If the influence of dilution were neglected, abnormal results were obtained. The colours should be matched at the period of maximum intensity, and reliable results could only be obtained with the unsaponifiable matter. There was a close correlation between the blue tintometer readings and the spectroscopic test, especially with halibut-liver oils.

Dr. R. J. McWalter demonstrated the construction of the Hilger spectrograph and the use of the 3280 spectrographic band in the estimation of vitamin-*A*. Mr. Norman Evers showed that even the blue value of the unsaponifiable matter of cod-liver oil might not be the true vitamin value. He pleaded for uniformity in the method of expressing results.

Mr. S. K. Crews and Mr. S. J. Cox read a paper on "The Relationship between the Carr-Price Value and 328 $m\mu$ Absorption Coefficient of Preparations containing Vitamin-*A*." They showed that the purification of vitamin-*A* products removes substances which inhibit the blue colour, and that eventually the ratio of the Carr-Price blue colour value to the ultra-violet absorption coefficient rises and tends to become constant. Details of the procedure for obtaining consistent results were described.

Dr. K. Coward said that in view of the international standards that were being issued an increasing degree of uniformity might be expected in biological methods, and she still put more faith in them than in chemical methods. Mr. A. H. Bennett contributed a note on the titration of vitamin-*C* in citrus juices by the use of Tillman's indophenol indicator. If iron is present in the juice a correction must be applied. Mr. K. Donovan pointed out that the addition, not only of sulphur dioxide, but also of any antiseptic substance to the juice to prevent fermentation would also destroy its vitamin-*C* activity.

## CORRESPONDENCE

### RANCIDITY OF OILS AND FATS

Sir, I have read with much interest the article by J. K. Giles in the issue of Chemistry and Industry dated October 13, on the "Taffel and Revis" method for the estimation of rancidity in oils and fats, and the reply by Taffel and Revis a fortnight later.

Giles refers to the unsuitability of the peroxide test carried out at ordinary temperature for use with solid fats, and with regard to Taffel and Revis's technique employing a temperature of 100° states that "in examining fats of very slight rancidity the variability of the blank on the reagents was found to limit the application of the test." Finally he suggests a modification whereby the blank titration may be reduced. Taffel and Revis in their reply maintain that the peroxide test should not be carried out at above 60°, and state that carbon tetrachloride (as used also by Wheeler) may be used to aid solution of the fat.

I should like to point out that on p. 31 of the Report of the Food Investigation Board for the Year 1929 (and quoted by the *Analyst*, 1930, **55**, 508) a quantitative peroxide-oxygen test is described in which "the fat is heated with a solvent mixture of glacial acetic acid-chloroform (2 : 1 by volume) in presence of solid potassium iodide. Oxidation of the reagent or fat during the process is prevented by previously filling the tube with nitrogen, while the steady evolution of chloroform vapour effectively prevents diffusion of oxygen back into the tube. The reaction mixture is cooled, poured into dilute potassium iodide, and titrated with 0·002*N*-thiosulphate solution." A number of oxidation curves for beef kidney fats (one of the hardest of the solid fats) under different conditions of temperature and illumination are given demonstrating the high degree of reproducibility obtainable with the method. Further results have since been published in Proc. Roy. Soc., 1931, **B, 108**, 175, and in a series of papers in this Journal.

The advantages possessed by the above procedure include: (*a*) 1 g. only (less of a highly oxidized fat) is required, and the reaction is carried out in test tubes; (*b*) the fat is in complete solution in a homogeneous liquid, so that no agitation beyond that produced by the boiling is necessary; (*c*) the determination is easy and rapid, and the blank on the reagents or on a perfectly fresh fat, *e.g.*, an animal fat examined immediately after death, is zero; (*d*) the test can still be applied in presence of connective tissue (protein) in not too large quantity. Taffel and Revis's "difficultly reducible peroxides" are not estimated by this method, but are not present to any considerable extent in edible fats which have become rancid at ordinary or at cold-storage temperatures.

A possible criticism is that the test as described is carried out in artificial light in order to eliminate all danger of oxidation during the process. For routine work, however, where extreme accuracy is not required, daylight (preferably subdued) may be substituted, and filling of the tube with an inert gas may be omitted, but under these conditions a blank determination on the reagents is necessary. Briggs[1] has obtained good

C

results with oxidized butter fats by means of this simplified technique.

Davies[2] and Coe and Le Clerc[3] refer to the methods of Taffel and Revis and of Wheeler[4] as being modifications of that I have described. Apparently Taffel and Revis were unaware of this earlier work: I cannot say whether the same is true of Wheeler, not having succeeded in obtaining his paper. I am, Sir, etc.,

Cambridge COLIN H. LEA

*Oct. 28, 1933*

[1] J. Dairy Res., 1931, **3**, 70.
[2] J. Dairy Res., 1932, **3**, 254.
[3] Cereal Chem., 1932, **9**, 519.
[4] Oil and Soap, 1932, **9**, 89.

## PERSONAL AND OTHER ITEMS

Dr. D. H. Ingall, who has been assistant director of the British Non-Ferrous Metals Research Association since 1931, has been appointed principal of the Borough Polytechnic, London, in succession to Mr. J. W. Bispham, O.B.E., who has been promoted to the post of assistant education officer (technology) under the London County Council.

We regret to learn of the death on November 3, at the age of 80, of Dr. Emile Roux, a former director of the Pasteur Institute. Dr. Roux worked for several years in Pasteur's laboratory, and was responsible for much work on filter-passing bacilli. He was the Copley medallist of the Royal Society in 1917.

Dr. E. B. Auerbach, a former president of the Berlin Chemical Society has recently accepted a position with the Keith Dunham Co. of Chicago.

### Royal Society Awards

The King has approved the award of Royal Medals by the Royal Society to Prof. G. I. Taylor, F.R.S. for his mathematical work in physics, geophysics, and aerodynamics, and to Mr. P. P. Laidlaw, F.R.S. for his work on diseases due to viruses. Prof. Taylor is Yarrow Research Professor of the Royal Society, and Mr Laidlaw is pathologist to the Medical Research Council.

The Davy Medal of the Royal Society has been awarded to Dr. W. H. Mills for his researches in organic chemistry and for his work on the syntheses and properties of the cyanine dyes, and more especially for the investigation of novel types of assymetric molecules. Dr. Mills is reader in stereochemistry in the University of Cambridge and was the Longstaff Medallist of the Chemical Society in 1930.

The Royal Society has also awarded the Copley Medal to Prof. T. Smith, professor of bacteriology in Columbia University, for his researches and observations on diseases of animals and man, and the Hughes Medal to Prof. E. V. Appleton, Wheatstone Professor of Physics in London University, for his researches into the effect of the Heavyside Layer upon the transmission of wireless signals.

### Public Works, Roads, and Transport Congress

The Public Works, Roads, and Transport Congress begins on Monday next, November 13, at the Royal Agricultural Hall, Islington, London, and will continue until Saturday, November 18. Whilst the congress is in progress an exhibition of plant, machinery, and materials for municipal purposes will be held in the Hall and will be open from 10 a.m. to 7 p.m. each day (admission 1s.).

Sessions of the congress will be held at 11 a.m. and 3 p.m. each day, beginning on Monday afternoon at 3 p.m., in the conference rooms in the North Gallery Annexe and the Berners Gallery. The first of the two sessions under the auspices of the Chemical Engineering Group of the Society will be held on Tuesday at 11 a.m. in the Berners Gallery: Major F. C. Cook will be the chairman and papers will be presented by Mr. R. G. C. Batson on "Laboratory Tests and their Correlation with full-scale Road Experiments," by Mr. D. G. Murdoch and Mr. W. G. Adam on "Some Factors Involved in the Mechanical Testing of Bituminous Mixtures," and Mr. Prevost Hubbard on "The Mechanical Testing of Bituminous Road Materials."

The second of the Society's sessions will be held at 3 p.m. in the same room, when papers will be given by Mr. D. M. Wilson on "The Mechanical Testing of Asphalt," Mr. D. C. Broome and Mr. A. R. Thomas on "Mechanical Tests and the Modern Highway" and Dr.-Ing. E. Neumann on "Mechanical Testing of Road Materials." Prof. G. T. Morgan will be the chairman at this session.

Many interesting subjects will be discussed at the other sessions of the congress which have been organized by the Institution of Gas Engineers, the British Waterworks Association, and similar bodies.

### American Section's New Award

The American Section of the Society has announced the institution of a new award to be called the "Chemical Industry Medal." This is to take the place of the Grasselli Medal, which has been awarded annually by the Section since 1920 and which has now been discontinued.

The first award of the new medal has been made to Mr. James G. Vail of the Philadelphia Quartz Co. for his work on sodium silicates. The presentation was made by Prof. Marston T. Bogert, a past-president of the Society, at a joint meeting of the Section with the American Chemical Society, the Electrochemical Society, and the Société de Chimie Industrielle, on November 3 at the Chemists' Club, New York. Mr. Vail is recognized in America as the leading authority on the uses of soluble silicates in industry. He is also well known for his activities in American scientific organizations.

### Institution of Chemical Engineers

A meeting of the Institution of Chemical Engineers is to be held on Wednesday next, November 15, at 6 p.m., in the rooms of the Chemical Society, Burlington House, when Dr. Friedrich Bergius of Heidelberg will present a paper on "The Utilization of Wood for the Production of Foodstuffs, Alcohol, and Glucose." The president of the Institution, Viscount Leverhulme, will be in the chair. Members of the Food Group and of the Chemical Engineering Group will no doubt appreciate the opportunity to hear Dr. Bergius, and the Institution has extended a cordial invitation to members of the Society to attend.

### Perkin Medal Award

Dr. Colin G. Fink, professor of electrochemistry at Columbia University, has been elected to receive the

Perkin Medal of the American Section of the Society of Chemical Industry for 1934. The medal is awarded annually for valuable work in applied chemistry, and will be presented to Dr. Fink for his inventions in the fields of metallurgy and electrochemistry. The selection is made by a committee representative of five of the American chemical societies. The presentation of the medal will be made at a meeting in New York early in January, details of which will be announced later.

#### Gluckstein Memorial Lecture

The subject of the S. M. Gluckstein Memorial Lecture of the Institute of Chemistry, to be given by Dr. Herbert Levinstein on December 15, is "The Chemist as a Directing Force in Industry."

#### American Institute of Chemical Engineers

The American Institute of Chemical Engineers has decided to hold its annual meeting at Roanoke, Virginia, on December 12, 13, and 14, instead of December 6–8, as originally planned. The change will enable members and visitors to attend the 14th Exposition of Chemical Industries, which is being held in New York from December 4 to 9.

#### Rayon Production

The production of rayon in the United Kingdom during September amounted to 8,100,000 lb., which was a record, production in September last year being 5,700,000 lb. The total for the first nine months of the year was slightly less than 60,000,000 lb., as compared with 54,000,000 lb. in the same period last year and 37,000,000 in 1931.

## COMPANY NEWS

### LAWES CHEMICAL MANURE CO., LTD.

The net profit of the company for the year ended June 30, 1933, was £6075, compared with £3316 in 1931–32. Payment of a dividend of 2½% on the ordinary shares is proposed, this being the first dividend paid for twelve years.

### UNITED STEEL COMPANIES, LTD.

The report of this group, which is controlled by Steel Industries of Great Britain, Ltd. shows a trading profit of £506,034 for the year ended June 30, 1933, an increase of £175,745 compared with the previous year. With £128,942 brought in and £250,000 placed to reserve for depreciation there is, after making deductions for interest on fixed loan and on mortgages etc., a sum of £230,380 to go forward. The report states that the company has benefited from the gradually increasing demand for semi-finished steel, and there has been a small improvement in the demand for other classes of steel.

### HARBEN'S (VISCOSE SILK MANUFACTURERS), LTD.

The company has given notice of the redemption of the 6½% second debenture stock on April 30, 1934. The principal and interest will be repaid together with £2 10s. % on the stock redeemed. The stock was first issued in 1926 to first preference shareholders, and there is £77,737 of the stock outstanding out of £100,000 authorized and issued.

## MARKET REPORT

**This Market Report is compiled from special information received from the manufacturers concerned.**

*Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.*

**The following alterations in prices are reported since the publication of the last Market Report (cf. Chem. & Ind., Nov. 3, 1933 p. 899).**

### GENERAL HEAVY CHEMICALS

Chromium Oxide.—10¾d. per lb., according to quantity, d/d U.K.

### TAR PRODUCTS

Benzole.—Prices at works: Crude, 10d.–10½d. per gal.; Standard motor, 1s. 5d.–1s. 5½d. per gal.; 90%, 1s. 6d.–1s. 7d. per gal.; Pure, 1s. 8½d.–1s. 9d. per gal.

Pitch, medium, soft.—75s. per ton, in bulk at makers' works.

Toluole.—90%, 2s. 7d.–2s. 8d. per gal. Pure, 3s. 1d. per gal.

### ESSENTIAL OILS

Eucalyptus, Australian B.P., 70/75%.—1s. 2d. per lb. Lavender, Mont Blanc, 38/40%.—18s. 6d. per lb. Lemon.—5s. per lb. Lemongrass.—4s. 6d. per lb. Orange, Sweet.—6s. 6d. per lb. Otto of Rose.—Anatolian, 33s. per oz.; Bulgarian, 45s. per oz. Palma Rosa, 8s. 6d. per lb.

## PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 6508 (1933). Linde Air Products Co. Purifying gases.

6510 (1933). Linde Air Products Co. Containers for liquefied gases.

6554 (1933). Linde Air Products Co. Purifying liquefied gases.

II. 6508 and 6554 (1933). Linde Air Products Co. *See* I.

III. 17,534 (1932). Deuts Gold- u. Silberscheideanstalt. Production of pentaerythrite.

33,630 (1932). I. G. Farbenind. Manufacture of hydroxynaphthotriazoles.

7243 (1933). Henkel & Co. Manufacture of mixed anhydrides of silicic acid and carboxylic acids.

11,510–11 (1933). Chem. Fabr. Stockhausen & Co. Sulphonation product containing a sulphonated halogen derivative of aliphatic alcohol.

11,568–9 (1933). I. G. Farbenind. *See* VI.

11,730 (1933). I. G. Farbenind. Compositions comprising chlorinated organic substances.

IV. 10,936 (1933). Durand & Huguenin A.-G. Manufacture of easily-soluble salts of sulphuric acid esters of leuco-vat-dyestuffs and process of dyeing and printing therewith.

V. 21,676 (1932). Papeteries Navarre. Manufacture of paper.

10,801 (1933). Nelson and Becker. Manufacture of paper or cloth.

11,567 (1933). Deuts. Celluloid-Fabr. Manufacture of films from cellulose derivatives.

VI. 10,936 (1933). Durand & Huguenin A.-G. *See* IV.

11,568–9 (1933). I. G. Farbenind. Manufacture of emulsifying, cleansing, wetting, or softening agents.

VII. 11,463 (1933). Frischer. Absorption and recovery of oxides of nitrogen.

IX. 11,609 (1933). Alfeis. Damp-, heat-, and sound-proof materials.

X. 3569—70 (1933). Aluminium, Ltd. Aluminium base alloys.

11,464 (1933). Verein. Glühlampen u. Electricitäts A.-G. Production of single-crystalled or large-crystalled metal bodies from tungsten.

11,781 (1933). Furukawa Denki Kogyo Kabushiki Kaisha. Copper alloy.

XIII. 11,476—8 (1933). Soc. Nobel Française. Preparation of artificial masses from vinyl derivatives.

XVII 10,309 (1933). Internat. Patents Development Co. Manufacture of starch from maize.

XIX. 28,204 (1932). Rojahn and Mercurio. Treating and preserving cattle fodder.

4760 (1933). Wallerstein Co. Treating substances containing protein materials.

XX. 11,566 (1933). Atzler. Remedy for tuberculosis etc.

XXI. 11,330 (1933). Karafiat and Cerny. Preparing light-sensitive layers on foils of regenerated cellulose.

## GENERAL NOTES

### Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Australia:* Tinplate (472). *Brazil:* Paint (497). *British India:* Paper (Director-General, India Store Department, Belvedere Road, Lambeth, London). *New Zealand:* Markets for *X*-ray and electro-medical apparatus (A.Y. 12,026). *Norway:* Electric welding machinery and electric-welding electrodes (487). *Poland:* Fish train-oil, stiffened train-oil, quicksilver, "red oxide," carbon black, aniline dyes for the textile, leather, and paint trades (489).

### Key Industry Duty

The Board of Trade has added carotene, cineol-orthocresol, synthetic menthol, and precipitated sulphur which satisfies the requirements of the British Pharmacopœia to List H of the Safeguarding of Industries Act, 1921, as amended by Section 10 of the Finance Act, 1926. The additions to the list take effect from November 3, 1933, and the chemicals cited are therefore now chargeable with duty at the rate of $33\frac{1}{3}\%$ *ad valorem* and cease to be chargeable under the Import Duties Act, 1932.

### Import Duties Advisory Committee

The Import Duties Advisory Committee give notice of the applications, (*a*) for the addition to the Free List of barytes, dry earth colours, rosin (colophony), and raw tung oil; (*b*) for a reduction of the import duty on magnet coils wound with aluminium wire adapted for use in electric hoists and separators.

Representations in regard to these applications should be addressed in writing to The Secretary, Import Duties Advisory Committee, Carxton House, Tothill Street, London, S.W.1, not later than November 27.

An Import Duties (Drawback) Order was put into operation on November 6, for the temporary allowance of drawback in respect of solid coal-tar pitch used in the manufacture of coal briquettes. The duration of the scheme is limited to eight months.

### Dyestuffs (Import Regulation) Act, 1920

The following statement relating to applications for licences under the Dyestuffs (Import Regulation) Act, 1920, made during October has been furnished to the Board of Trade by the Dyestuffs Advisory Licensing Committee. The total number of applications received during the month was 883, of which 804 were from merchants or importers. To these should be added the eight cases outstanding on September 30, making a total for the month of 891. These were dealt with as follows: Granted, 870 (of which 865 were dealt with within 7 days of receipt); referred to British makers of similar products, 17 (of which 13 were dealt with within 7 days of receipt); outstanding on October 31, 4. Of the total of 891 applications received, 878 or 99% were dealt with within 7 days of receipt.

### Dangerous Drugs Acts

The Home Secretary has given notice of his intention to make regulations under the Dangerous Drugs Acts for controlling the manufacture, possession, and wholesale distribution of methylmorphine ("codein"), ethylmorphine ("dionin"), and their respective salts. Copies of the draft regulations may be obtained from the Under-Secretary of State, Home Office, Whitehall, S.W.1.

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CORRECTION TABLES FOR USE WITH PLATINUM RESISTANCE THERMOMETERS. By G. S. Callendar and F. E. Hoare, Ph.D. Pp. 12. London: E. Arnold & Co., 1933. 1s.

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PIGMENT AND COLOR INDEX OF 1933: SPECIFIC GRAVITY, WEIGHT PER GALLON, BULKING VALUE, FINENESS AND OIL ABSORPTION OF OVER 1200 WHITE AND COLORED PIGMENTS. By H. A. Gardner, J. R. Stewart, and A. W. Van Heuckeroth. Pp. 274—400. Circular No. 444. Issued August, 1933. Scientific Section. Washington, D.C.: American Paint and Varnish Manufacturers' Association.

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